

Management

This activity is done best in small groups. If only one tape measure is available, the activity may be done as a whole class activity which makes the measurement of the area faster.

Before the activity select a playing field or room to scale. Basketball, volleyball, and tennis courts all provide appropriate areas. If no such area is available, a classroom can be sufficient.

Procedure

Discuss the *Key Question*.

Challenge the students to determine the height of a typical basketball player. This may be done through research or by choosing an appropriate height. (6'6" = 200 cm works well.)

Distribute a toy soldier to each group and have them measure and record its height.

Ask the students to determine and record the scale factor of the toy soldier to an actual basketball player.

Have them draw a sketch of the basketball court. Allow time for them to measure and record all the necessary measurements for the court. Inform students they need only measure to the nearest whole unit (inch, cm).

Direct them to use the scale factor to reduce all the court measurements and then to use the scaled dimensions to draw the scaled court on a piece of butcher paper.

Have students use their drawings to determine the lengths of diagonal passes across the court and then confirm the lengths on the actual basketball court.

Discussion

1. Ask questions such as:

- Using your drawing and a ruler, how far would a player have to throw a pass from one corner of the court to a teammate on the center line on the opposite side?
- How long would a pass be diagonally from corners on opposite end lines?

Confirm the answers on the actual court. Encourage students to frame questions to ask of each other.

2. Why did you only have to measure the actual court to the nearest centimeter (or inch)? [It becomes insignificant when scaled.]
3. Of what use is a scale drawing?
4. What scale drawings have you used? [maps, layouts of shopping malls, etc.]

Extension

The structured sequence described in the *Procedure* provides a shared experience with which to talk about the concepts being developed. Following this experience with a more open approach allows the students to extend and reinforce their understanding. Have each group bring an action figure from home and make a scaled floor plan of the classroom based on their heights and the heights of the action figures. Floor plans will be different sizes because they are based on different scales caused by varying sizes of action figures and heights of students.

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TOY SOLDIERS TAKE THE COURT

Topic

Measurement and Scaling

Key Question

How could you make a basketball court that was scaled to the size of a toy soldier?

Focus

Students will measure a basketball court and make a scale drawing of it based on a toy soldier.

Guiding Documents

Project 2061 Benchmarks

- *The scale chosen for a graph or drawing makes a big difference in how useful it is.*
- *Scale drawings show shapes and compare locations of things very different in size.*
- *Estimate distances and travel times from maps and the actual size of objects from scale drawings.*

*NCTM Standards 2000**

- *Develop, analyze, and explain methods for solving problems involving proportions, such as scaling and finding equivalent ratios*
- *Work flexibly with fractions, decimals, and percents to solve problems*
- *Solve problems involving scale factors, using ratio and proportion*
- *Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects*

Math

Proportional reasoning
scaling
Measuring
length

Integrated Processes

Observing
Collecting and recording data

Applying

Generalizing

Materials

Toy soldiers
Rulers
Tape measures, 30m
Butcher paper

Background Information

In making scale drawings an appropriate scale must be chosen. This is often chosen for convenience and ease of calculations. Using a toy soldier to establish the scale produces a situation that develops a deeper understanding of scale.

The height of the person the toy represents must be determined. This may be done by choosing an arbitrary, but reasonable, size or by doing a data analysis of adult heights.

When the height the toy represents has been selected the height of the toy soldier must be measured. The accuracy and precision of that measurement again affects the outcome of the project. The differences in measurement is increased by toy soldiers having varying heights. This creates a situation for determining an average height.

When the heights of the toy and person it represents have been determined, they rarely provide a scale factor which is an integer. This generates a situation that requires some conceptual development. Some students will need to physically compare the height of the toy to an actual person's height to develop an approximation of the scale factor. This may require that they count how many toy soldiers high the actual person is. From this stage students can be asked to consider how to get the scale factor numerically. Most will move to a division strategy. The calculated scale factor can be compared to the physically counted scale factor to confirm the meaning of the number.

When the scale factor is determined and understood, it can be used to reduce the actual measurements of the world to the scaled measurements appropriate for the toy.

The accuracy of scale drawing can be found by enlarging scaled measurements by the scale factor to find the actual dimensions.

